



Matter

Matter is everything that has mass and that occupies a space.

Matter is the substance which makes up a body.

When we observe an object, we notice qualities such as its shape, its size, its colour and its beauty. All these elements are properties of matter but we cannot **measure** them all.

Some properties have **quantities** which can be measured, for example **mass** and **volume**.

Mass and volume

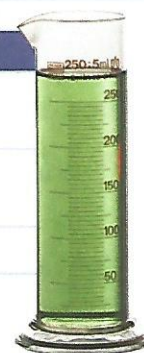
Mass measures the amount of matter that a body possesses. The unit of mass in the International System of Units (SI) is the **kilogram** (kg). We use submultiples of the kg: gram (g), decigram (dg), centigram (cg) and milligram (mg). Mass is measured with scales or an electronic balance.

Volume is the **space** that a body occupies. The SI unit is the **cubic metre** (m³). We also use the cubic decimetre (dm³) and the cubic centimetre (cm³). The volume of solid bodies, liquids and gases can be measured with a measuring cylinder.

The **capacity** of a vessel is the maximum volume that it can contain. We can therefore express the volume of a liquid in units of volume (m³, dm³, cm³) or the unit of measurement of the vessel which contains it: litre (l), decilitre (dl), centilitre (cl) or millilitre (ml).

Physical size	SI Unit	Unit equivalence
Mass	1 kg	1 kg = 1,000 g = 1,000,000 mg 1 kg = 10 ³ g = 10 ⁶ mg
Volume	1 m ³	1 m ³ = 1,000 dm ³ = 1,000,000 cm ³ 1 m ³ = 10 ³ dm ³ = 10 ⁶ cm ³

Volume	Equivalence in units of capacity
1 m ³	1 kl = 1,000 l = 1,000 000 ml 1 kl = 10 ³ l = 10 ⁶ ml
1 dm ³	1 l = 1,000 ml 1 l = 10 ³ ml
1 cm ³	1 ml



Density

Density measures the **ratio** between the mass of a body and the volume it occupies. The SI unit is kg/m³. We also use g/cm³.

To calculate density (P), we divide the mass (m) by the volume (V).

$$\rho = \frac{m}{V}$$

(ρ = density, m = mass of the body, V = volume of the body)

The density of water (at 4°C) is 1,000 kg/m³ or 1 kg/dm³ or 1 g/cm³.